[redacted]

NEW MEXICO ENVIRONMENT DEPARTMENT

Construction Programs Bureau

Recommended Standards for Wastewater Facilities

POLICIES FOR THE DESIGN, REVIEW, AND APPROVAL OF PLANS AND SPECIFICATIONS FOR WASTEWATER COLLECTION AND TREATMENT FACILITIES

2003 Edition

EXHIBIT
tabbies
3214-10

Recommended Standards for Wastewater Facilities

2003 Edition

"The guidelines set forth in this document, Recommended Standards for Wastewater Facilities, are intended solely for the guidance of employees of the New Mexico Environment Department (NMED). They are not intended to, nor do they, constitute regulations promulgated by NMED, the New Mexico Environmental Improvement Board, or the New Mexico Water Quality Control Commission, and are not enforceable as such. They may not be relied upon to create a right or benefit, substantive or procedural, enforceable at law or in equity, by any person.

The guidelines set forth in this document have been developed to assist NMED in consistently reviewing plans and specifications submitted for wastewater system improvements and construction. They incorporate nationally recognized guidelines for engineering practices in furtherance of public health and environmental protection as modified by NMED to address New Mexico practices and particulars. They do not contain criteria required by NMED for approval of plans and specifications, and are not intended to supersede any grant or loan requirements or any policy, requirement, or regulation concerning wastewater system improvements or construction. NMED will review all plans and specifications objectively and with professional judgment to establish whether they conform to applicable laws, regulations, and engineering requirements and practices. NMED encourages the development and implementation of new processes and equipment, and will favorably consider them with the appropriate demonstration of successful applications.

Portions of this document are reproduced with permission from the Great Lakes - Upper Mississippi River Board of State and Provincial Public Health Environmental Managers, *Recommended Standards for Wastewater Facilities*, 1997 Edition. Comments concerning the guidelines set forth herein should be provided to: New Mexico Environment Department, Construction Programs Bureau Chief, P.O. Box 26110, Santa Fe, NM 87502.

Ron Curry, Cabinet Secretary

10/1/03
Date

CHAPTER 130

PONDS

130. WASTEWATER TREATMENT PONDS

130.1 GENERAL

This Section deals with three generally used variations of treatment ponds that are used in achieving secondary treatment and settling (or clarification) ponds used for polishing and solids processing. The secondary treatment ponds include facultative ponds, partial-mix aerated ponds, and complete-mix aerated ponds. The treatment ponds discussed in this Section will be used as building blocks to a comprehensive treatment system. Ponds, as discussed herein, are also commonly referred to as lagoons. Ponds used for equalization, percolation, evaporation, and solely for biosolids storage are not discussed.

130.2 DEFINITIONS

130.2.1 Facultative Ponds

Facultative ponds have traditionally been the most common type of pond. Other terms by which they are commonly known include oxidation ponds, sewage ponds, and photosynthetic ponds. The term "facultative" is derived from the pond's use of both aerobic and anaerobic processes to achieve biological conversion in the water column. Aerated ponds can provide for settling, stabilization, and storage of biomass. Keys to facultative operation are oxygen production by photosynthetic algae, passive aeration by the atmosphere, and a stratified water column with both aerobic and anaerobic activity zones. Algae are necessary for oxygen production, but their presence in the final effluent can be problematic. Facultative ponds can discharge effluent continuously, intermittently, or not at all. Intermittent discharge ponds are large and effluent is discharged several times a year when quality is high. Total-containment ponds can work when water lost to evaporation greatly exceeds rainfall.

130.2.2 Partial-Mix Aerated Ponds

An aerated pond supplies oxygen mainly through mechanical or diffused aeration. Aerated ponds are advantageous because they require less land area than facultative ponds and can produce a more dependable quality of effluent.

Aerated ponds provide for biological conversion and can provide for settling, stabilization, and storage of biomass. In partial-mix ponds, energy input is sufficient to meet some or all of the ponds oxygen requirements but is insufficient to maintain all of the solids in suspension.

130.2.3 Complete-Mix Aerated Ponds

A complete-mix pond supplies oxygen through mechanical or diffused aeration. Complete-mix ponds provide for influent biodegradable carbon to be converted to biomass and flocculation of the biomass, but do not provide for solids settling, stabilization, or for biosolids storage. Energy input to complete-mix ponds is sufficient to retain all solids in suspension.

130.2.4 Settling Ponds

Settling ponds are dedicated to polishing the wastewater from a secondary treatment process and will be relied on to settle suspended solids, stabilize those solids, and store the resulting biosolids. Biological conversion may occur but will not be relied upon. A settling basin may be facultative or partial-mixed aerated.

130.2.5 Biosolids Stabilization

Stabilization reduces the fraction of solids, deposited at the bottom of a water column, which is biodegradable. In low-turbulence environments, most of the biomass produced in the system, along with the settleable fraction of the nonbiodegradable suspended solids in the influent, will settle in the pond to form bottom deposits or biosolids. Before removal and disposal, the biodegradable solids portion of the biosolids will be reduced to a level where it offers no threat to the disposal environment.

130.3 LOCATION

130.3.1 Surface Runoff

Adequate provision will be made to divert stormwater runoff around the ponds and protect pond embankments from erosion.

130.3.2 Ground Water Separation

A minimum separation of 4 feet (1.2m) between the bottom of the pond and the maximum ground water elevation will be maintained.

130.3.3 Bedrock Separation

A minimum separation of 10 feet (3.0m) between the pond bottom and any bedrock formation is recommended.

130.4 BASIS OF DESIGN

130.4.1 Reduction of Biochemical Oxygen Demand

130.4.1.1 Facultative Ponds

Because there is essentially no way to quantitatively control treatment processes in a facultative pond, and because treatment performance can vary widely, facultative ponds will be designed only with extreme caution when discharge limits will be reliably met.

TABLE 130.1

Temperature	Average for All Cells		Primary Cell	
	BOD_5 Loading Range[a]	Minimum Retention Time[b]	Maximum BOD_5 Loading[a]	Minimum Retention Time[b]
Above 15ºC	40-80 lbs/ac·d (45-90 kg /ha·d)	90 days	89 lbs/ac·d (100 kg /ha·d)	60 days
Between 0ºC & 15ºC	20-40 lbs/ac·d (22-45 kg /ha·d)	120 days	67 lbs/ac·d (75 kg/ha·d)	90 days
Below 0ºC	10-20 lbs/ac·d *(11-22 kg/ha·d)*	180 days	35 lbs/ac·d *(40 kg/ha·d)*	120-180 days

a.) Calculated for the mean operating depth over the primary pond(s). Do not include area of secondary ponds in loading.
b.) **Calculated for volume between the 2-foot (610 mm)** and maximum operating depth of the entire pond system.

Better treatment is obtained when the flow is guided more carefully through the pond. In addition to treatment efficiency, economics and aesthetics play an important role in deciding whether or not baffling is desirable. In general, the more baffling is used, the better are the flow control and treatment efficiency. The lateral spacing and length of the baffle will be specified so that the cross-sectional area of flow is as close to a constant as possible.

Wind generates a circulatory flow in bodies of water. To minimize short-circuiting due to wind, the pond inlet/outlet axis will be aligned perpendicular to the prevailing wind direction, if possible. If this is not possible, baffling can be used to control wind-induced circulation to some extent. In a constant-depth pond, the surface current will be in the direction of the wind, and the return flow will be in the upwind direction along the bottom, aligned perpendicular to the prevailing wind direction.

130.5 POND CONSTRUCTION DETAILS

130.5.1 Embankments and Dikes

130.5.1.1 Material

Dikes will be constructed or relatively impervious soil and compacted to at least 90% standard proctor density to form a stable structure. Vegetation and other unsuitable materials will be removed from the area where the embankment is to be placed.

130.5.1.2 Top Width

The minimum dike width will be 8 feet (2.4 m) to permit access for maintenance vehicles.

130.5.1.3 Maximum Slopes

Inner and outer dike slopes will not be steeper than 1 vertical to 3 horizontal (1:3).

130.5.1.4 Minimum Slopes

Inner slopes will not be flatter than 1 vertical to 4 horizontal (1:4). Flatter slopes can be specified for larger installations because of wave action but have the disadvantage of added willow areas being conducive to emergent vegetation. Outer slopes will be sufficient to prevent surface runoff from entering the ponds.

130.5.1.5 Freeboard

Minimum freeboard will be 3 feet (910 mm), except that for small systems 2 feet (600 mm) may be acceptable.

130.5.1.6 Design Depth

The minimum operating depth will be sufficient to prevent growth of aquatic plants and damage to the dikes, bottom, control and outlet structures, aeration equipment, and other appurtenances. In no case will pond depths be less than 6 feet (600 mm).

a. *Facultative Ponds*
The minimum water depth will be 6 feet (1.8 m) in primary cells. Greater depths in subsequent cells are recommended although supplemental aeration or mixing may be necessary.

b. *Partial-Mix & Complete-Mix Aerated Ponds*
The design water depth will be 10-15 feet (3-4.5 m). Ponds may be designed deeper depending on the aeration equipment, desired water column stratification, waste strength, and climatic conditions.

130.5.1.7 Liner Thickness

The thickness of soil/clay liners will be adjusted for the anticipated maximum wastewater depth in the pond and in no case less than 18 inches thick (constructed in 6-inch lifts). Contact the appropriate regulatory authority for liner thickness specifications.

130.5.1.8 Erosion Control

A justification and detailed discussion of the method of erosion control which encompasses all relative factors such as pond location and size, liner material, topography, prevailing winds, cost breakdown, application procedures, etc., will be provided.

a. Seeding

The dikes will have a covered layer of at least 4 inches (100 mm), of fertile topsoil to promote establishment of an adequate vegetative cover wherever riprap is not utilized. Adequate vegetation will be established on dikes from the outside toe to 2 feet (600 mm) inside the outside top edge. Perennial-type, low-growing grasses and/or plants that minimize erosion and are suited for the local climate are most satisfactory for seeding on dikes. In general, long-rooted crops will not be used for seeding since the roots of this type are apt to impair the water-holding efficiency of the dikes.

b. Additional Erosion Protection

Riprap, concrete or some other acceptable method of erosion control is required as a minimum around all piping entrances and exits. For aerated cells the design will ensure erosion protection on the slopes and bottoms in the areas where turbulence will occur. Additional erosion control may also be necessary on the exterior dike slope to protect the embankment from erosion due to severe flooding of a watercourse.

c. Alternate Erosion Protection

Alternate erosion control on the interior dikes slopes may be necessary for ponds, which are subject to severe wave action. In these cases riprap, concrete lining, or an acceptable equal, will be placed from one foot (300 mm) above the high water mark to two feet (610 mm) below the low water mark (measured on the vertical).

130.5.2 Pond Bottom, Dike Cores, & Liners

130.5.2.1 Selection of Liner Material

NMED recommends the use of synthetic liners as the most reliable and environmentally protective lining material currently available. Synthetic liners are suitable for a wide variety of applications. Soil/clay liners are not recommended for the following applications or conditions:

a. fluctuating wastewater levels (e.g., evaporative ponds) or where ponds are used seasonally (e.g., storage ponds) which due to drying and/or dessication may result in compromised liner integrity.

b. where wastewater is not chemically compatible (e.g, pH<5 or pH>10)

c. where a facility is located in an area of concern with respect to aquifer vulnerability:

1. water table aquifer (includes both unconfined and semi-confined conditions) with a vadose zone thickness of 100 feet or less, containing no soil or rock formation that will act as a barrier to saturated or unsaturated wastewater flow,

2. an aquifer with known anthropogenic anoxic or nitrate contamination,

3. an aquifer overlain by fractured bedrock,

4. an aquifer in karst terrain,

5. an aquifer with a public water supply well located within 1000 feet of the proposed pond or a gaining stream known to be impacted by nutrients from liquid waste systems.

d. unusually high strength wastewater (e.g., total N>85, BOD>400, TSS>350)

130.5.2.2 Earth

Earth used in constructing the pond bottom and dike cores will be relatively incompressible and tight and compacted at or up to 4% above the optimum water content to at least 90% standard proctor density – ASTM D 698.

130.5.2.3 Liners

Ponds will be sealed such that seepage loss through the bottom and sides is as low as practicably possible. Seals consisting of soils, bentonite, or synthetic liners may be considered provided the permeability, durability, and integrity of the proposed material can be satisfactorily demonstrated for anticipated conditions.

a. *Soil/Clay Liners*

In order for a soil to be accepted for use in a compacted soil liner, it will have: a saturated hydraulic conductivity no greater than $1x10^{-7}$ cm/sec at 90% standard proctor density - ASTM D 698,

1.) at least half its material passing a #200 sieve,

2.) a Plasticity Index of no less than 10%, and

3.) particles no larger than 4 mm (5/32-in).

If a soil does not meet the hydraulic conductivity it will be augmented with bentonite clay.

Samples of the liner material will be tested for standard proctor density, Atterberg limits, gradation, and characterization per Uniform Soil Classification System, and saturated hydraulic conductivity. Samples will be taken whenever the visual quality of the material changes and for every 5,000 cubic yards of visually similar material. Hydraulic conductivity tests only need to be performed on every fourth sample of visually similar material. During construction, each lift of a compacted soil liner will be field tested for density according to ASTM D 2922 and D 3017, at the rate of 5 tests per acre of bottom area or 200 feet of dike length as applicable. The liner material will be protected from desiccation or anything that will compromise its integrity during construction. Wastewater stored in a clay lined lagoon will have a pH greater than 5 and less than 10 and will contain less than 50% organic chemical content.

An independent soils/geotechnical lab will perform the tests and the results will be recorded on a NMED Compacted Test Results (CTR) form. If required, an independent lab will also determine and verify bentonite augmentation requirements. Soil description and classification will be determined using ASTM D 2487. A copy of the CTR and ASTM forms will be submitted prior to constructing the pond. Laboratory test results for hydraulic conductivity and calculations for clay augmentation recipe, if required, will include:

1.) the method used,
2.) the soil's optimum moisture content and maximum dry density,
3.) the bentonite's type and grade, and
4.) the location of the pits or borrow areas from which the materials were obtained.

b. Synthetic Liners

The liner material chosen will be chemically compatible with the wastewater, resistant to deterioration by sunlight (or covered in areas that may be exposed), and of sufficient thickness and strength to withstand wave/wind action and pedestrian maintenance activities. Synthetic liners will be at least 40 mils thick if strand reinforced, or at least 60 mils if un-reinforced (film material). Liners will be placed on a suitable foundation of sand or fine soil. Consideration will be given to slip resistance surfaces when the liner is exposed around pond edges. Liner material and foundation will be approved by a New Mexico Registered Professional Engineer and the NMED prior to installation.

130.5.2.4 Uniformity

The pond bottom will be as level as possible at all points. Finished elevations will not be more than 3 inches (80 mm) from the average elevation of the bottom.

130.5.2.5 Prefilling

Prefilling the pond will be considered in order to protect the liner, to prevent weed growth, to reduce odor, and to maintain the liner's moisture content.

130.5.3 Inlet Works

Multiple inlet arrangements will be used, even in small ponds. Inlet points will be as far apart as possible, and the water will preferably be introduced by means of a long diffuser designed to avoid plugging. Single inlets can be used if the inlet is located at the greatest distance possible from the outlet structure and is baffled, or the flow is otherwise directed to avoid currents and short-circuiting.